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(56) Documents Cited
GB 2260279 A **GB 0792603 A**

(58) Field of Search
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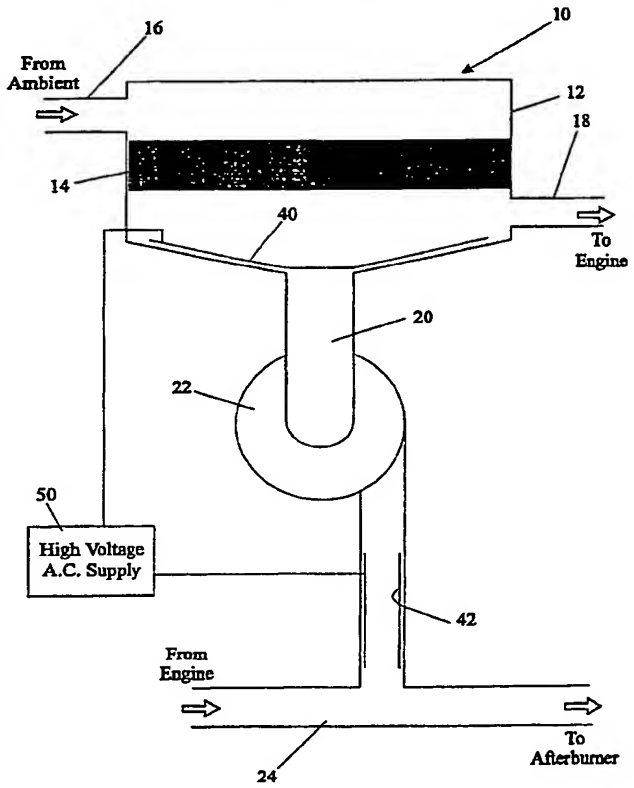
Online Databases:- W.P.I. and CLAIMS

(54) Reducing light-off time of a catalytic converter

(57) In an internal combustion engine having an exhaust gas catalytic converter and fitted with an afterburner to assist in raising the temperature of the catalytic converter during cold starts, an ozonizer 42 is provided for ozonizing the additional air mixed with the exhaust gases in the afterburner to improve the ignitability of the mixture in the afterburner.

An additional ozonizer 40 is located in the air filter casing 12.



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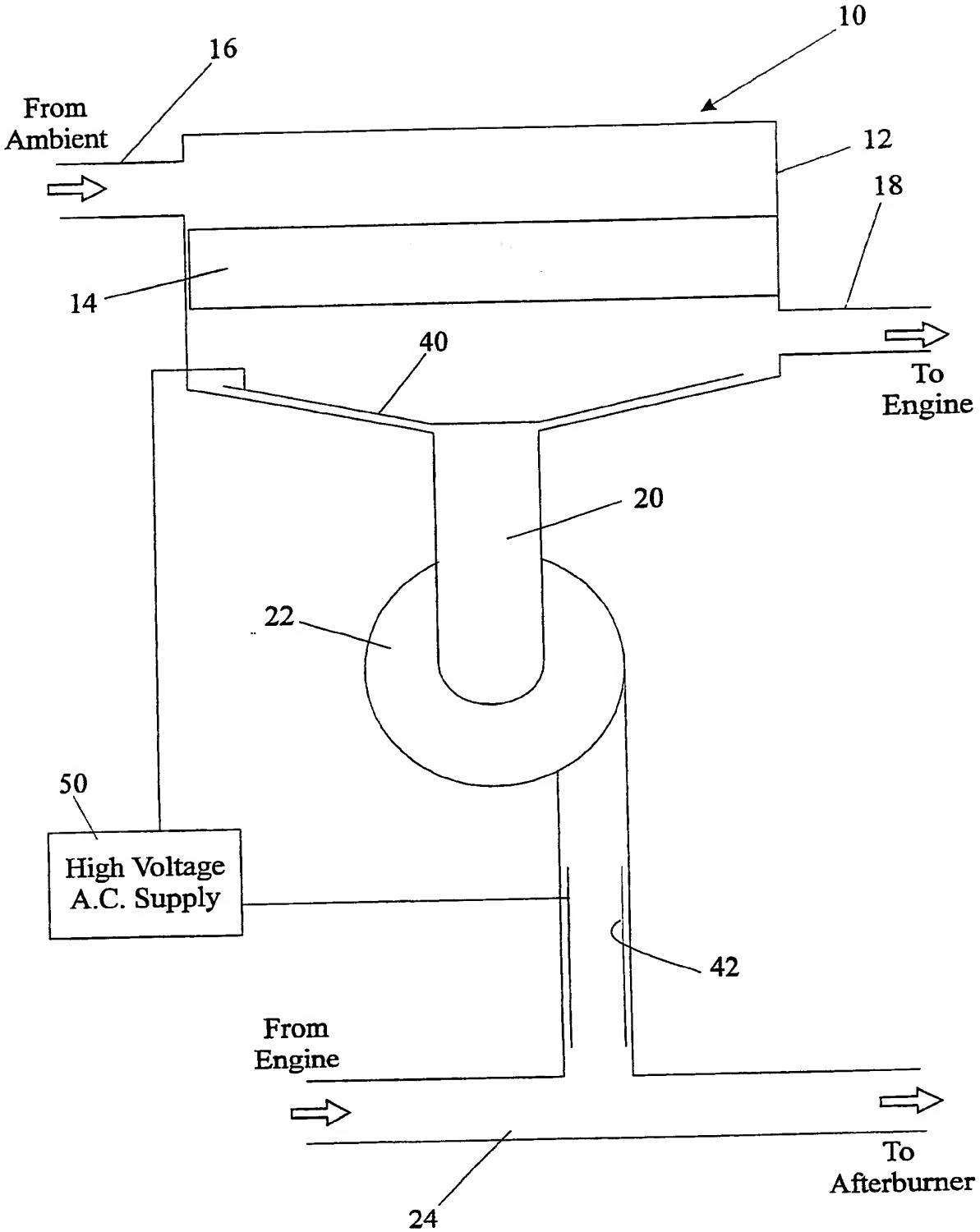

REDUCING LIGHT OFF TIME OF A CATALYTIC CONVERTER

Field of the invention

The present invention relates to an internal combustion engine having a catalytic converter and fitted with an afterburner to assist in raising the temperature of the catalytic converter during cold starts.

It has already been proposed to use an afterburner to reduce the light off time of a catalytic converter, the fuel burnt in some cases being passed through the combustion cylinders while in other cases it is injected directly into the exhaust stream, air being added directly into the exhaust system in all cases. The mixture strength in such systems has to be precisely controlled in the afterburner for ignition to be possible and in practice the ignitability window, that is to say the range of concentrations of the various constituents that can be ignited when cold, is fairly small, making it necessary to use accurate metering equipment to achieve ignition reliably.

Object of the invention

The narrow ignitability window therefore results in additional expense, if reliability is to be achieved, and the present invention seeks to improve the ignitability of the mixture in the afterburner so as to increase the measurement and control latitude.

Summary of the invention

According to the present invention, there is provided an internal combustion engine having an exhaust gas catalytic converter and fitted with an afterburner to assist in raising the temperature of the catalytic converter during cold starts, wherein an ozonizer is provided for ozonizing

the additional air mixed with the exhaust gases in the afterburner.

By ozonizing the additional air, the activity of the oxygen in the mixture in the afterburner is increased, which widens the ignitability and flammability windows.

The ozonizer may suitably comprise two electrodes separated one another by a gap through which the additional air is ducted to the afterburner and means for applying an electrical potential between the two surfaces to give rise to a silent or glow discharge.

One of the two surfaces may conveniently form part of the casing of an air cleaner or a tube carrying the additional air to the afterburner, so that only one additional surface needs to be added to the components already present.

The means for generating the required electrical potential may either be an inverter driven by the battery coupled to an induction coil or step-up transformer. Alternatively, an alternating voltage may be derived directly from a winding on a vehicle alternator, the winding being especially provided for this purpose.

Brief description of the drawing

The invention will now be described further, by way of example, with reference to the accompanying drawing which is schematic representation of a source of additional air for and afterburner.

Description of the preferred embodiment

In the drawing there is shown an air filter box 10 having a casing 12 that houses a filter element 14. A duct 16 draws in ambient air and a second duct 18 conducts the filtered

air to the engine intake manifold. Additionally the air casing 12 has an outlet 20 that supplies filtered air to an additional air pump 22. The pump 22 in turn delivers the air into the exhaust pipe 24 of the engine, upstream of the afterburner chamber. Within the afterburner chamber the additional air is used to burn fuel that is either already present in the exhaust gases or is separately introduced into the afterburner chamber. The design and function of the afterburner are known per se and need not therefore be described in detail in the present context.

To improve the ignitability of the mixture in the afterburner chamber the present invention proposes ozonizing the additional air supplied by the pump 22. As shown in the drawing, an ozonizer can be arranged either upstream or downstream of the pump, or both. Each ozonizer comprises two metal electrodes, which may be plates or a mesh, separated from one another by a gap through which all or part of the additional air flows. A high voltage is applied across the electrodes, e.g. 5 to 10 kV at a frequency of 1 to 10 kHz to give rise a silent or glow discharge that ozonizes the oxygen in the gap.

The two ozonizers shown in the drawing use as one of the electrodes a surface that is already present in the engine. The upstream ozonizer uses the casing 12 of the air cleaner box and a plate 40 supported on it in an insulated manner, while the downstream ozonizer uses the duct connecting the additional air pump to the exhaust pipe and a concentric tube 42 supported within it in an insulating manner. The pairs of plates are connected across an high voltage AC supply 50 that comprises, for example, an inverter and a step-up transformer.

The activity of the oxygen in the ozonized air is higher than that in untreated air. Because of this, the mixture in the afterburner is more readily ignitable and more tolerant

to variations in the ignitable ingredients of the mixture. For this reason, the additional air need not be accurately metered and, as seen in the drawing, the need for a regulating valve or a flow meter in the additional air supply may be obviated. It may also be possible to run the engine with a less rich mixture while still achieving reliable ignition in the burner.

It is not essential that the electrodes surfaces of an ozonizer come into contact with the air passing through it as it is the electrostatic field that is responsible for the breakdown discharge and such a field can pass through an insulator. The surfaces may therefore be covered with an insulator to avoid electrical shock to an operator accidentally coming into contact with part of an ozonizer.

CLAIMS

1. An internal combustion engine having an exhaust gas catalytic converter and fitted with an afterburner to assist in raising the temperature of the catalytic converter during cold starts, wherein an ozonizer is provided for ozonizing the additional air mixed with the exhaust gases in the afterburner.

2. An internal combustion engine as claimed in claim 1, wherein the ozonizer comprises two electrodes separated from one another by a gap through which the additional air is ducted to the afterburner and means for applying an electrical potential between the two electrodes to give rise to a silent or glow discharge.

3. An internal combustion engine as claimed in claim 2, wherein one of the two electrodes forms part of the casing of an air cleaner or a duct carrying the additional air to the afterburner.

4. An internal combustion engine as claimed in claim 2 or 3, wherein the means for generating the required electrical potential comprises an inverter coupled to an induction coil or step-up transformer.

5. An internal combustion engine as claimed in claim 2 or 3, wherein an alternating voltage is derived directly from a dedicated winding on an alternator.

6. An internal combustion engine having an additional air supply constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawing.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Relevant Technical Fields

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Search Examiner
J H Warren

Date of completion of Search
15 April 1993

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES : WPI & CLAIMS

Documents considered relevant following a search in respect of Claims :-
1-6

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2270269 A	(FORD) afterburner 16, catalyst 106	1
Y	GB 0792603 A	(FUX) page 1, lines 63-74	1

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).